USER MANUAL

Accessory 58E

UMAC RESOLVER/SSI ACC-58E

3Ax-603482-xUxx

MAY 4, 2010

DELTA TAU
Data Systems, Inc.
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REVISION HISTORY				
REV.	**DESCRIPTION**	**DATE**	**CHG**	**APPVD**
1	MANUAL RELEASE	10/02/09	CP	J.SCHATZ
2	UPDATED MAPPING TABLE, P.5	05/04/10	CP	M.YAHYAEI

Table of Contents

INTRODUCTION

Delta Tau's ACC-58E UBUS Resolver and SSI Accessory is a sine wave input resolver or optionally SSI interface designed to interface 2 (optionally 4) resolver-based or SSI-based encoders to Delta Tau Data System's UBUS Euro card style devices.

The ACC-58E is a 3U size card that mounts in the Delta Tau Turbo UMAC.

As of the printing of this manual, the ACC-58E does not work with the UMAC MACROSTATION.

Features

When used as a resolver interface:

- The ACC-58E interface accepts inputs from two (optionally 4) resolver style encoders or SSI-style encoders and provides encoder position data to the motion processor. This interface creates 4,096 steps per resolver pole.
- The resolver interface accepts an input of approximately 1Vp-p signal from the encoder. The ACC-58E also has a sinewave generator that is capable of producing up to approximately 7Vp-p signal.
- The sine-cycle frequency of the generator is expected to be the operating frequency of the resolver. The sine cycle frequency is determined by setting a divider register to divide the UMAC's phase clock by a factor of 1, 2, 4, or 6.
- It appears that for best operation that the UMAC SERVO clock should be set to match the resolver frequency.

When used as an SSI encoder interface:

- To be provided in future update. Contact Delta Tau for details.

For all ACC-58E applications:

- The ACC-58E accessory card is a UBUS product that has a Euro card connector which allows it to be placed in the same rack as a UMAC or MACRO station processor.
- The ACC-58E is a CS2 or CS3 device in the UBUS backplane. Therefore the memory map for this card is similar to the ACC-24E2x-style axis cards.

Board Configuration

Base Configuration

The base version of the ACC-58E consists of a 3U size board with 2 resolver inputs or SSI inputs.

Options

OPT A	30A-603482-OPT	16-bit A-D for channel 1 & 2
OPT B	30B-603482-OPT	12-bit A-D for channel 1 & 2
OPT 1A	31A-603482-OPT	16-bit A-D for additional 2 Axes (Axis 3 & 4)
OPT 1B	31B-603482-OPT	12-bit A-D for additional 2 Axes (Axis 3 & 4)
OPT 2	302-603482-OPT	SSI option for channel 1 & 2
OPT 3	303-603482-OPT	SSI option for channel 3&4

Opt A:

Provides the interface circuitry and connectors for 2 resolver encoders, 16-bit for channel 1 & 2 encoders on the ACC-58E.

Opt B:

Provides the interface circuitry and connectors for 2 resolver encoders, 12-bit for channel 1 & 2 encoders on the ACC-58E.

Opt 1A:

Provides the interface circuitry and connectors for 2 additional resolver encoders, 16-bit for a total of four encoders on the ACC-58E.

Opt 1B:

Provides the interface circuitry and connectors for 2 additional resolver encoders, 12-bit for a total of four encoders on the ACC-58E.

Opt 2:

Provides the interface circuitry and connectors for 2 SSI-style encoderst for channels 1 & 2 on the ACC-58E.

Opt 3:

Provides the interface circuitry and connectors for 2 additional SSI-style encoders for a total of four encoders on the ACC-58E.

NOTE

The options described above must be installed at the factory.

Indicators

Please refer to the layout diagram of the UBUS ACC-58E card for the location of the indicator on the board.

D1 POWER Indicator

This LED indicates that there is power on the UMAC and that the UMAC system is running correctly.

SPECIFICATIONS

Environmental Specifications

Description	Specification	Notes
Operating Temperature	0°C to 45°C,	
Storage Temperature	-25°C to 70°C	
Humidity	10% to 95 % non-condensing	

Physical Specifications

Description	Specification	Notes
Dimensions	Length: 16.256 cm (6.4 in.) Height: 10 cm (3.94 in.) Width: 2.03 cm (0.8 in.)	
Weight w/o Option 1A	220 g	Front , Top, and Bottom plates included
The width is the width of the front plate. The length and height are the dimensions of the PCB.		

Electrical Specifications

Description	Specification	Notes
ACC-58E Power Requirements	5V @ 0.5A (±10%) +15V @ 0.08A (±10%) -15V @ 0.04A (±10%)	

Safety

Item	Description
Flammability Class	UL 94V-0

LAYOUT OF ACC-58E UBUS RESOLVER INTERFACE

Below is a diagram showing jumpers and connectors on the ACC-58E.

RESERVED FOR FUTURE LAYOUT PICTURE

Dipswitch Configuration

S1 is a 4-point dipswitch that determines how the ACC-58E is to be mapped to a Turbo UMAC processor or MACRO station processor.

Acc-58E Mappings when Used with UMAC Turbo CPU

The table below shows the addresses and switch settings used for the Turbo UMAC models:

ACC-58E MAPPING TABLE
{CS2, CS3 MAPPINGS WHEN USED WITH UMAC TURBO CPU}

Interp SW1 Settings				Turbo PMAC Servo IC # (m)	1st Channel	2nd Channel	3rd Channel	4th Channel	I-vars	CS16 Ident. Address
4	3	2	1							
on	on	on	on	2	$78200	$78208	$78210	$78218	I7200-I7249	$78F08
on	on	on	off	3	$78300	$78308	$78310	$78318	I7300-I7349	$78F0C
on	on	off	on	2*	$78220	$78228	$78230	$78238	I7250-I7259	$78F28
on	on	off	off	3*	$78320	$78328	$78330	$78338	I7350-I7359	$78F2C
on	off	on	on	4	$79200	$79208	$79210	$79218	I7400-I7449	$79F08
on	off	on	off	5	$79300	$79308	$79310	$79318	I7500-I7549	$79F0C
on	off	off	on	4*	$79220	$79228	$79230	$79238	I7450-I7459	$79F28
on	off	off	off	5*	$79320	$79328	$79330	$79338	I7550-I7559	$79F2C
off	on	on	on	6	$7A200	$7A208	$7A210	$7A218	I7600-I7649	$7AF08
off	on	on	off	7	$7A300	$7A308	$7A310	$7A318	I7700-I7749	$7AF0C
off	on	off	on	6*	$7A220	$7A228	$7A230	$7A238	I7650-I7659	$7AF28
off	on	off	off	7*	$7A320	$7A328	$7A330	$7A338	I7750-I7759	$7AF2C
off	off	on	on	8	$7B200	$7B208	$7B210	$7B218	I7800-I7849	$7BF08
off	off	on	off	9	$7B300	$7B308	$7B310	$7B318	I7900-I7949	$7BF0C
off	off	off	on	8*	$7B220	$7B228	$7B230	$7B238	I7850-I7859	$7BF28
off	off	off	off	9*	$7B320	$7B328	$7B330	$7B338	I7950-I7959	$7BF2C

The memory mapping for Turbo UMAC models allows for a total of 64 encoder channels to be selected. The dipswitch selects between any of the 16 banks of memory. This allows for up to 16 ACC-58Es to be logically configured.

NOTE

The ACC-58E defines the mapping for its encoder channels as the same as the mapping for other devices that provide encoder inputs. Therefore, although there are 16 four-channel memory "slots" to place the ACC-58E into, these same "slots" are shared with the axis cards.

FEEDBACK SIGNAL CONNECTIONS

Low capacitance shielded twisted pair cable is ideal for wiring resolvers. The better the shield wires, the better the noise immunity to the external equipment wiring. Wiring practice for shielded cables is not an exact science. Different applications will present different sources of noise, which may require experimentation to achieve the desired results. Therefore the following recommendations are based upon some experiences that we at Delta Tau Data Systems have acquired.

If possible, the best cabling to use is a double shielded twisted pair cable.

The shield wires should be tied to ground (Vcc return) at the resolver end. It is acceptable to tie the shield wires together if there are not enough terminals available. Keep the exposed wire lengths as close as possible to the terminals on the accessory card.

NOTE

It has been observed that there is an inconsistency in the shielding styles that are sometimes provided by different encoder manufacturers.

Be sure to check pre-wired resolvers to insure that the shield wires are ***NOT*** connected at the resolver's side. Shield wires should only be connected on one side of the cable.

If your resolver has shield wires that are connected to case ground, insure that the resolver and motor cases are sufficiently grounded and do not connect the shield at the resolver end.

If your resolver has pre-wired double shielded cable that has only the outer shield connected at the resolver, then connect only the inner shield wires to the resolver. Be sure not to mix the shield interconnections.

One possible cable type for encoders is Belden 8163 or ALPHA 6317. This is a 3-pair individually shielded cable that has an overall shield. This double shielded cable has a relatively low capacitance and is a 100Ω impedance cable.

NOTE

If noise is a problem in your application, careful attention must be given to the method of grounding that is used in your system. Amplifier and motor grounding can play a significant role in how noise is generated in a machine.

It is possible that noise may be reduced in a motor-based system by the use of inductors that are placed between the motor and the amplifier.

ACC-58E RESOLVER SETUP

The key to proper Acc-58E setup is to understand the key registers and I-variables associated with the excitation outputs and resolver signal inputs. The key registers and I variables are as follows:

```
I7m00-Max Phase Frequency
I7m01-Phase clock divider
I7m02-Servo Clock Divider
I7m06-DAC Strobe word

I8000-8192 –Encoder Conversion table (6 entries per resolver needed)

Ixx03-Position Feedback address
Ixx04-Velocity feedback Address
Ixx71- Counts per commutation cycle (if UMAC is performing the
commutation)
Ixx83- Commutation Feedback address

Ixx75- Phase offset register for Power-on Phase
Ixx81 – Power on Phase Position Adddess
Ixx91- Power on Phase Position Method

Y:$78F0D – Excitation Magniture Register
Y:$78F0F – Excitation Frequency Register
```

Refer to the TURBO PMAC Software Reference Manual for a more detailed description of the use of the I-variables as described below.

ADC Strobe I7x06

The ADC Srobe word associated with the Servo IC located on the ACC-58E must be set to $1FFFFF for proper operation. If the ACC-58E is located at base address $78300, we would set I7306= $1FFFFF.

Encoder Servo Feedback I-vars

Servo feedback is established from the set of I-variables for each channel located at Ixx03 and Ixx04. These values are addresses that establish an encoder reference used by the servo feedback algorithms to maintain a motor’s position.

The following encoder table addresses are suggested when they are set up from the procedure that is outlined in ‘ENCODER CONVERSION TABLE’ in the PMAC software manuals. Refer to the table below:

	Ixx03,Ixx04 Value	**Conversion Table 1st Line Entry**	**Conversion Table 2nd line Entry**	**Conversion Table 3rd line Entry**
PROCESSED ENCODER #1		I8000	I8001	I8002
Exponential Filter #1	$3506	I8003	I8004	I8005
PROCESSED ENCODER #2		I8006	I8007	I8008
Exponential Filter #2	$350C	I8009	I8010	I8011
PROCESSED ENCODER #3		I8012	I8013	I8014
Exponential Filter #3	$3512	I8015	I8016	I8017
PROCESSED ENCODER #4		I8018	I8019	I8020
Exponential Filter #4	$3518	I8021	I8022	I8023
PROCESSED ENCODER #5		I8024	I8025	I8026
Exponential Filter #5	$351E	I8027	I8028	I8029
PROCESSED ENCODER #6		I8030	I8031	I8032
Exponential Filter #6	$3524	I8033	I8034	I8035
PROCESSED ENCODER #7		I8036	I8037	I8038
Exponential Filter #7	$352A	I8039	I8040	I8041
PROCESSED ENCODER #8		I8042	I8043	I8044
Exponential Filter #8	$3530	I8045	I8046	I8047

NOTE

The encoder table addressing starts at memory location $3501. Turbo PMAC processes all table entries until it finds a ***first*** line entry set to 00 (unused). There *MUST NOT* be any address gaps between the first and last encoder table entry.

Motor xx Counts per N Commutation Cycles (Ixx71)

For a Turbo PMAC-commutated motor, this parameter defines the size of a commutation cycle in conjunction with Ixx70 (hardware counts/cycle = Ixx71/Ixx70. This unit is in whole counts and the information processed in the encoder conversion table has 5-bits of fraction associated with it and because we are commutating from the processed register of the encoder conversion table we must multiply our counts per commutation cycle by 32 or 2^5. For example, if we are getting back 4096 counts per revolution then we would set Ixx71=4096*32 or Ixx71=131072

Motor xx Number of Commutation Cycles (N) (Ixx70)

For a PMAC-commutated motor (Ixx01=1), Ixx70 is used in combination with Ixx71 to define the size of the commutation cycle, as Ixx71/Ixx70 counts Ix83 will contain the address of the hardware counter's phase capture register.

Commutation Position I-vars (Ixx83)

The ACC58E does not contain an encoder register that may be used for commutation position. The UMAC processor must point to the output of the encoder conversion table entry (as in the table above at Ixx03,Ixx04) to track a motor's position.

Encoder Conversion Table For Resolver Inputs

The encoder conversion table is a user configurable list of entries that may be assigned to different specific data processing inputs. The resolver is assigned into the encoder conversion table as a Resolver when using PEWINPRO's executive program conversion table setup menu. This 3 line encoder table entry uses a method digit value (bit 16-23) of $Fxxxxx followed by $4xxxxx for the second line. Refer to section 5 in the Turbo PMAC software reference for "ENCODER CONVERSION TABLE SETUP LINES" (I-vars I8000-I8191) for details.

Due to the low resolution nature of a resolver input, it is also recommended to apply an Exponential filter to the resolver data in the conversion table.

The following table describes the three-line I8xxx variables that need to be configured for the resolver. This table shows the settings for 4 axes and includes the exponential filter settings.

It should be noted that a 2 channel ACC-58E resolver (without OPT 1A or 1B) uses 4-channel address field settings. 2 channel resolvers may not overlap 4 channel boundaries.

```
Encoder Table Definitions.
 Entry    Address      Y-Word     Conversion Method
----------------------------------------------------
   1      Y:$  3501    $F78305    Resolver
          Y:$  3502    $478F0C     Excitation address
          Y:$  3503    $000000     SIN/COS Bias word
   2      Y:$  3504    $D03503    Exponential filter from conv. location $3503
          Y:$  3505    $020000     Maximum change in cts/cycle
          Y:$  3506    $100000     Filter gain
   3      Y:$  3507    $F7830D    Resolver
          Y:$  3508    $478F0C     Excitation address
          Y:$  3509    $000000     SIN/COS Bias word
   4      Y:$  350A    $D03509    Exponential filter from conv. location $3509
          Y:$  350B    $020000     Maximum change in cts/cycle
          Y:$  350C    $100000     Filter gain
   5      Y:$  350D    $F78315    Resolver
          Y:$  350E    $478F0C     Excitation address
          Y:$  350F    $000000     SIN/COS Bias word
   6      Y:$  3510    $D0350F    Exponential filter from conv. location $350F
          Y:$  3511    $020000     Maximum change in cts/cycle
          Y:$  3512    $100000     Filter gain
   7      Y:$  3513    $F7831D    Resolver
          Y:$  3514    $478F0C     Excitation address
          Y:$  3515    $000000     SIN/COS Bias word
   8      Y:$  3516    $D03515    Exponential filter from conv. location $3515
          Y:$  3517    $020000     Maximum change in cts/cycle
          Y:$  3518    $100000     Filter gain
```

Changing the Direction Sense of the Resolver feedback.

To change the direction sense of the resolver, the user must simply enable bit-19 of the first entry for the encoder channel. For example, if we have the following:

```
I8000=$F78305

I8001=$478F0C

I8002=$000000

I8003=$D03503
```

```
I8004=$020000
I8005=$100000
```

To change the direction sense would need to change the I8000 register to the following:
`I8000=$FF8305.`

Power On Phase Setup

Since we are using a register from the encoder conversion table for position and phase data we will also use this register for power on phase position. Ixx81 will be set to the encoder table entry that is used for position feedback.

For this method we use the normal method used for setting resolvers for any PMAC. We must setup the following registers:

```
Ixx75- Phase offset register
Ixx81 – Power on Phase Position Adddess
Ixx91- Power on Phase Position Method
```

The phase offset register (Ixx75) will be setup by applying current to the motor phases to calculate the resolver phase position relative to the motor windings.

The power on phase address (Ixx81) is the same register used by Ixx83. For example if Ixx83=$3506 then you will set Ixx81=$3506.

The power on Phase Phase Method (Ixx91) will be setup to process a 24-bit parallel word from an X-word. So we will set Ixx91=$580000.

Setting Ixx75 for ACC-58E

The proper value for this parameter can be found with a simple procedure that should be done with an unloaded motor, after satisfactory operation has been achieved using a power-on phasing search.

• Define an M-variable to the absolute sensor if using one. For the ACC-58E we will point at the processed data from the encoder conversion table. For example, if we are using position data from location $3508 (I103=$3508), then we will look at X:$3508,24,s. M4000->X:$3508,24,s

• Give the motor an **O0** command.

• Put a bias (a magnitude of 2000 is usually good) on the A phase (higher-numbered DAC of a pair for Turbo PMAC) by setting Ixx29; use a positive bias for Ixx82=0 and Ixx72>1024 (e.g. 1365 or 1536); use a negative bias or if Ixx82>0 for digital current loop closure or if Ixx82=0 and Ixx72<1024 (e.g.683 or 512)

• Also, put a bias in the opposite direction of the same magnitude on the B phase by setting Ixx79. The motor should lock in on a position like a stepper motor.

• Now remove the A-phase bias by setting Ixx29 back to zero, or at least to the value found to force zero current in the phase, and the motor should lock in on another position. This position is the zero position of the phasing cycle.

• If there is an absolute sensor, after sure that the motor has settled, read the position of the absolute

sensor by querying its M-variable value.

• Take the negative of this value, multiply it by Ixx70, and put the resulting value in Ixx75. If the value is greater than Ixx71, then you will have to take the modulo of this value. The PMAC uses the '%' symbol for the modulo function. For ACC-58E, Ixx71 will always be 131072.
Ixx75=((-1)*M4000*Ixx70)%131072 ;M4000 is when the value when Ixx79 is energized and Ixx29=0.

• Now, with Ixx79 returned to zero or the proper bias, and Ixx81 pointing to the absolute sensor, give the motor a **$** command. The motor should be properly phased.

• If doing this to use the **SETPHASE** command at a known position such as the index, set the internal phase position register to 0 with Mxx71.

• Return Ixx79 to zero or the proper bias, and close the loop with a **J/** command.

• Now move to the reference position (e.g. do a homing search move with the index pulse as the trigger) and make sure it is settled there with minimal following error (some integral gain should be used).

• Read the value of Mxx71 at this point and set Ixx75 to this value.

• Remember to save these variable values before doing a full reset on the card

Example Phase Offset Setup for Ixx75 for Channel 1

The only register we need to read for this exercise is the absolute data from the processed data of the encoder conversion table. Since Ixx75 is cannot be greater than the value of Ixx71, we must use the Modulo function (%) in case the absolute data processed by the encoder conversion table exceeds the value of Ixx71 (typically 131072 for Resolvers). Lastly, Delta Tau recommends that this portion of the setup be done with the motor disconnected from the load. For this example Ixx82>0 (direct PWM commutation).

Assume that we are using $3506 from the encoder conversion table to obtain our resolver position data (i.e. I103=$3506, I104=$3506, I183=$3506).

```
M4000->X:$003506,24,S ; Resolver #1 Absolute position

#1o0            ;enable Motor #1
I129=-2000      ;Place a negative bias in the A phase of the motor
I179=2000       ;Place a positive bias in the B phase of the motor
I129=0          ;Remove baias from A Phase. Moves motor to known
                ;location in electrical cycle


M4000           ;Read M1000 or rx$3506
3036856        ;Pmac responds with M4000=3036856

I179=0          ;Remove Bias from B Phase
#1K             ;disable (kill) motor 1
```

```
I175=(-3036856*I170)%I171   ;Ixx75=[(-1)*(M4000 when I179 energized)*Ixx70]%Ixx71
                            ;I175=(-3036856*2)%131072 = 86672
I181=I183  ;Power on phase position is from Phase position register
           ;Actual word is from encoder conversion table ($3506 for example).
I191=$580000        ;Read Ixx81 as an 24-bit parallel X-register
```

Now you should be able to phase the motor 1 with the #1$ command.

Clock Settings

Another important concept to understand when using the ACC-58E is how clock settings are to be set for successful operation. The two concepts covered in this section are the excitation signal generation and the actual resovler signal sample data.

The excitation signal generated by the ACC-58E is derived from the phase clock. The phase clock is generated by the main clock generating card in the unit and derived from the Max Phase Frequency register. This will typically be the first servo card in the UMAC system or the ACC-5E. For more details about the clock generation for the UMAC CPU please refer to the Turbo PMAC2 System Clock Source section of the Turbo PMAC User Manual.

Warning

The ACC-58E excitation signal circuitry limits the user to have a maximum phase clock frequency of 10 KHz.

The input signals from the resolver are interpreted in our encoder conversion table (ECT) and this is done every servo interrupt or you can think of this occurring at the servo frequency. The servo frequency is derived from the phase clock. This is an important concept because the users of the ACC-58E will typically be using motors that the Turbo PMAC is commutating and the commutation calculations are done at the phase clock frequency. The feedback data used for commutation should be done at the same frequency as the phase clock and the user should set the servo clock equal to the phase clock.

Example 1: Umac has two ACC-24E's and one ACC-58E. The system uses I7200 to generate the clock speed, and the other servo cards use I7300 and I7400 to control their inner clock but are synchronized to the clock generated by the first ACC-24E2. For this example we wish to change the phase clock to be 24 KHz. Assume the clocks are at their factory defaults (~9KHz Phase and 2.25kHz Servo) I7200, I7300, and I7400=6527

Since the desired result is greater than 2x that of the current value we must change the clocks of the ACC-24's.

The first step is to change the clocks of the ACC-24's associated with the non-clock sourcing ACC-24's

I7300=2456

I7400=2456

Then change settings on the clock sourcing ACC-24

I7200=2456 ;Sets Max Phase frequency to 24KHz and PWM frequency to 12 KHz

I7201=2 ;Sets phase clock to 8 KHz (Max Phase/(1+I7201)

I7202=0 ;Sets Servo clock to 8 KHz (Phase/(1+I7202)

Issue SAVE

Issue $$$ or Power cycle

If the customer changes the clock setting of the clock sourcing ACC-24E2 before changing the clock settings of the non-clock sourcing ACC-24E2's, they will see the power good LED's of the ACC-24E2's turn off but once they change the clocks of the ACC-24E2's and issue a save and then power cycle the system, the system will function properly

Example 2: Umac has an ACC-5E (generates master clock) and two ACC-24E2A's and an ACC-58E. The ACC-5E uses I6800 to generate the clock speed, and the ACC-24's and ACC-58 use I7200, I7300, and I7400 respectively to control their inner clock but are synchronized to the clock generated by the ACC-5E. For this example, we wish to change the Max phase frequency to 24 KHz to give use a 12KHz PWM frequency and set phase clock and servo clock to be 8 KHz. Assume the clocks are at their factory defaults (~9KHz Phase and 2.25kHz Servo) or I6800=6527 and I7200, I7300, and I7400=6527

Since the desired result is greater than 2x that of the current value we must change the clocks of the ACC-24's and that of the ACC-5E.

The first step is to change the clocks of the ACC-24's.

I7200=2456

I7300=2456

I7400=2456

Then change main clocks on the ACC-5E

I6800=2456 ;Sets Max Phase frequency to 24KHz and PWM frequency to 12 KHz

I6801=2 ;Sets phase clock to 8 KHz (Max Phase/(1+I6801)

I6802=0 ;Sets Servo clock to 8 KHz (Phase/(1+I6802)

If the Acc-5E has option1 (extra MACRO gate) installed then change I6850=2456 also.

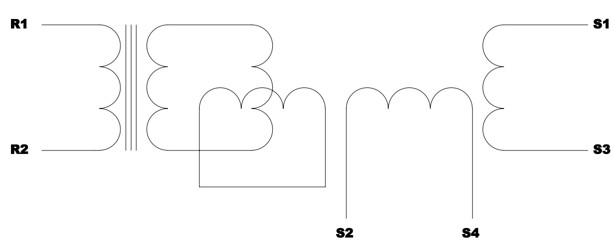
Issue SAVE

Issue $$$ or Power cycle

If the customer changes the clock setting of the ACC-5E before changing the clock settings of the ACC-24E2's, they will see the power good LED's of the ACC-24E2's turn off but once they change the clocks of the ACC-24E2's and issue a save and then power cycle the system, the system will function properly.

Excitation Signal Setup

The Excitation Signal from the ACC-58E is the output frequency and magnitude signal that is used by the resolver. This signal wires directly to R1 and R2 on the resolver.



As mentioned in the Clock Settings section, the excitation frequency is setup by the Phase clock setting from the main clock used by the controller.

For example if the user wanted a phase clock frequency of 4.5 Khz and they had an Acc-24E2 as the main clock, they would have the following settings:

I7200=6527 ;Max Phase of 9.0 Khz

I7201=1 ;Phase clock = MaxPhase/(1+I7201) = 4.5 Khz

Excitation Voltage Control Register

The most important signal to setup is the excitation output voltage. Currently the user must use the register at Y:$078F0D,8,4.

The default value for this register is 1. This value results in an excitation magnitude of less than 1.5Vpp. For most resolvers, an excitation value of 5Vpp to 10Vpp is needed to send back sin and cosine signals between 2.5Vpp and 5Vpp for the ACC-58E to process as position data via its ADC circuitry. If we define an M-variable to this location we can then use this to setup the register to our desired value.

```
M8000->Y:$078F0D,8,4
```

Register Value	Excitation Magnitude*
M8000=12	9.5Vpp
M8000=11	8.8Vpp
M8000=8	6.5Vpp
M8000=4	3.6Vpp

* When connected to an actual resolver the voltages will drop slightly.

For most resolvers with a 1:2 ratio, we recommend setting this register to 11 for the 8.8Vpp value.

Excitation Frequency Control Register

The excitation control register is located at Y:$78F0F,8,4. The register allows us to divide the base excitation frequency by 1, 2, 4, or 6. The base excitation frequency is based on the phase clock settings for the UMAC system. For example if the phase clock is set at 6 KHz, then we could divide this down to 3KHz, 1.5KHz, or 1 KHz if needed.

```
M8001->Y:$078F0F,8,4
```

Register Value	Frequency Divide Value
M8001=0	1
M8001=1	2
M8001=2	4
M8001=3	6

For most resolvers, phase clock frequency divider of 1 or 2 (M8000=0 or 1) should be appropriate when the phase clock is less than 9 KHz.

Warning

The UMAC CPU does not store the values of the excitation voltage control register or the excitation frequency control register. Therefore, the user must either download these values after power-on or use a PLC program to initialize these two registers at power-on.

ACC-58E Setup Example

The UMAC System has an ACC-24E2 and is at the base address of $78200 and ACC-58E located at $78300. The main servo clock is generated by the ACC-24E2.

```
;Encoder Conversion Table
i8000=$F78305
I8001=$478F0C
i8002=$000000
I8003=$D03503
i8004=$020000
i8005=$100000


;Main Clock Setup -from Acc24E2 at base location $78200
i7200=6527
i7201=1          ;set phase clock to 4.5 KHz
i7202=0         ;set servo clock equal to phase clock

i7306=$1FFFFF    ;DAC Strobe Word Setup from Acc-58E at $78300

M8000->y:$78F0D,8,4   ;Excitation Magnitude Control
M8001->Y:$78F0F,8,4   ;Excitation Frequency Divide
M8000=12              ;excitation voltage = 8.8Vpp
M8001=0               ;excitation frequency divider=0+1

I103=$3506            ;Motor 1 Position Address
I104=$3506            ;Motor 1 'Velocity' Address
I171=131072           ;Motor 1 Counts Per N Commutation Cycles *32
I183=$3506            ;Motor 1 Commutation Position Address
```

Using the PMAC Executive

The PMAC executive program is ideal for setting up the encoder conversion table. There is a list of configuration options in the “CONFIGURE ENCODER TABLE” part of the executive.

Choose consecutive entries as desired for each encoder’s configuration. Select “Resolver” as the conversion style. Be sure that the correct encoder source channel number is also selected.

Note the address of the processed data reported in the upper-left portion of the window.

Download the new encoder table data to UMAC and select the “View All Encoder Entries” function to verify that your entries are correct.

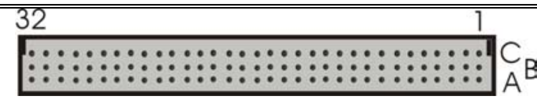
When finished, close the "Configure Encoder Table" window and type "`SAVE`" to store your new encoder table data.

With the above process completed, you should notice the data from the resolver appear in the position window (when Imn00=1).

CONNECTOR DESCRIPTIONS

P1: UBUS Interface Connector

(96 pin EURO-Connector)



Front View on Accessory Card

Pin #	Row A	Row B	Row C
1	+5Vdc	+5Vdc	+5Vdc
2	GND	GND	GND
3	BD01	DAT0	BD00
4	BD03	SEL0	BD02
5	BD05	DAT1	BD04
6	BD07	SEL1	BD06
7	BD09	DAT2	BD08
8	BD11	SEL2	BD10
9	BD13	DAT3	BD12
10	BD15	SEL3	BD14
11	BD17	DAT4	BD16
12	BD19	SEL4	BD18
13	BD21	DAT5	BD20
14	BD23	SEL5	BD22
15	BS1	DAT6	BS0
16	BA01	SEL6	BA00
17	BA03	DAT7	BA02
18	BX/Y	SEL7	BA04
19	CS3-	BA06	CS2-
20	BA05	BA07	CS4-
21	CS12-	BA08	CS10-
22	CS16-	BA09	CS14-
23	BA13	BA10	BA12
24	BRD-	BA11	BWR-
25	BS3	MEMCS0-	BS2
26	WAIT-	MEMCS1-	RESET
27	PHASE+	IREQ1-	SERVO+
28	PHASE-	IREQ2-	SERVO-
29	ANALOG GND	IREQ3-	ANALOG GND
30	-15Vdc	PWRGUD	+15Vdc
31	GND	GND	GND
32	+5Vdc	+5Vdc	+5Vdc

Note:

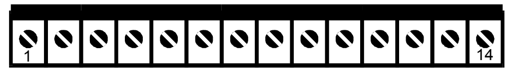
This table represents the standard UBUS backplane connector. The gray boxes represent signals that are not connected on this accessory board.

J1 Programming Header

This 6-pin header is used by manufacturing to program the on-board logic devices.

TB1, TB2 Encoder Inputs For Terminal Block Inputs

(14 pin Mini-Combicon)



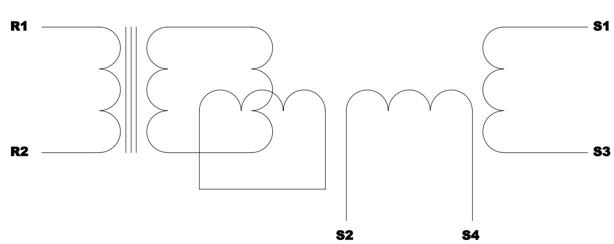
Front View

Pin #	Symbol	Function	Description	Notes
1	S2	Analog Input	Sinusoidal input+	
2	S4	Analog Input	Sinusoidal input-	
3	S3	Analog Input	Cosine input+	
4	S1	Analog Input	Cosine input-	
5	INDEX+	Input	Index input	
6	INDEX-	Input	Index input	
7	CLK+	Input	RS485 digital +	
8	CLK-	Input	RS485 digital -	
9	DATA+	I/O	RS485 digital +	
10	DATA-	I/O	RS485 digital -	
11	R1	Output	Resolver Output	Sinusoidal Analog
12	GND (R2)		Digital ground	--Connect R2 Here--

J1, J2 Encoder Inputs for DB15 Connector

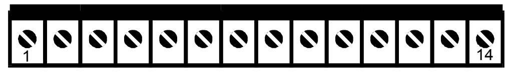
(15 pin DSUB Connector)

Pin#	Symbol	Function	Description	Notes
1	S2	Analog Input	Sinusoidal input+	
2	S3	Analog Input	Cosine input+	
3	INDEX+	Input	Index input	
4	CLK+	Input	RS485 digital +	
5	DATA+	I/O	RS485 digital +	
6	R1	Output	Resolver Output	
7	VREF	2.5V Output	A-D reference output	
8	+5V	PWR	+5Vdc	
9	S4	Analog Input	Sinusoidal input-	
10	S1	Analog Input	Cosine input-	
11	INDEX-	Input	Index input	
12	CLK-	Input	RS485 digital -	
13	DATA-	I/O	RS485 digital -	
14	GND (R2)		Digital ground	--Connect R2 Here--
15	GND		Digital ground	



TYPICAL RESOLVER WIRING

TB3, TB4 Encoder Inputs For Terminal Block Inputs

(14 pin Mini-Combicon)			 Front View	
Pin #	**Symbol**	**Function**	**Description**	**Notes**
1	S2	Analog Input	Sinusoidal input+	
2	S4	Analog Input	Sinusoidal input-	
3	S3	Analog Input	Cosine input+	
4	S1	Analog Input	Cosine input-	
5	INDEX+	Input	Index input	
6	INDEX-	Input	Index input	
7	CLK+	Input	RS485 digital +	
8	CLK-	Input	RS485 digital -	
9	DATA+	I/O	RS485 digital +	
10	DATA-	I/O	RS485 digital -	
11	R1	Output	Resolver Output	Sinusoidal Analog
12	GND (R2)		Digital ground	--Connect R2 Here--

J3, J4 Encoder Inputs for DB15 Connector

(15 pin DSUB Connector)				
Pin#	**Symbol**	**Function**	**Description**	**Notes**
1	S2	Analog Input	Sinusoidal input+	
2	S3	Analog Input	Cosine input+	
3	INDEX+	Input	Index input	
4	CLK+	Input	RS485 digital +	
5	DATA+	I/O	RS485 digital +	
6	R1	Output	Resolver Output	
7	VREF	2.5V Output	A-D reference output	
8	+5V	PWR	+5Vdc	
9	S4	Analog Input	Sinusoidal input-	
10	S1	Analog Input	Cosine input-	
11	INDEX-	Input	Index input	
12	CLK-	Input	RS485 digital -	
13	DATA-	I/O	RS485 digital -	
14	GND (R2)		Digital ground	--Connect R2 Here--
15	GND		Digital ground	

APPENDICES

Offset Register Mapping Definitions

All of the registers in the table below are located inside DSPGATE1. Refer to the DSPGATE1 in the Turbo Software Reference Manual under PMAC2 I/O Control Registers for details on the use of these registers.

Only the clock and ADC registers are used on the ACC-58E.

	ADDR	X -Memory	Y-Memory
First Channel	Base + 00h	Status Word 1	Time Between Enc Counts (SCLKs)
	Base + 01h	Phase Raw Count 1	Time Since Last Enc Count (SCLKs)
	Base + 02h	Servo Count 1	Output A Command (PWM/DAC)
	Base + 03h	Flag Position Capture 1	Output B Command (PWM/DAC)
	Base + 04h	Global Clock Control 1-4	PWM C1
	Base + 05h	Control Word 1	Ext ADC_A
	Base + 06h	Enc Compare Auto Increment 1	Ext ADC_B
	Base + 07h	Enc Compare Value B1	Enc Compare Value B1
Second Channel	Base + 08h	Status Word 2	Time Between Enc Counts (SCLKs)
	Base + 09h	Phase Raw Count 2	Time Since Last Enc Count (SCLKs)
	Base + 0Ah	Servo Count 2	Output A Command (PWM/DAC)
	Base + 0Bh	Flag Position Capture 2	Output B Command (PWM/DAC)
	Base + 0Ch	DAC Strobe Output Word 1-4	PWM C2
	Base + 0Dh	Control Word 2	Ext ADC_A
	Base + 0Eh	Enc Compare Auto Increment 2	Ext ADC_B
	Base + 0Fh	Enc Compare Value B2	Enc Compare Value B2
Third Channel	Base + 10h	Status Word 3	Time Between Enc Counts (SCLKs)
	Base + 11h	Phase Raw Count 3	Time Since Last Enc Count (SCLKs)
	Base + 12h	Servo Count 3	Output A Command (PWM/DAC)
	Base + 13h	Flag Position Capture 3	Output B Command (PWM/DAC)
	Base + 14h	ADC Strobe Output Word 1-4	PWM C3
	Base + 15h	Control Word 3	Ext ADC_A
	Base + 16h	Enc Compare Auto Increment 3	Ext ADC_B
	Base + 17h	Enc Compare Value B3	Enc Compare Value B3
Fourth Channel	Base + 18h	Status Word 4	Time Between Enc Counts (SCLKs)
	Base + 19h	Phase Raw Count 4	Time Since Last Enc Count (SCLKs)
	Base + 1Ah	Servo Count 4	Output A Command (PWM/DAC)
	Base + 1Bh	Flag Position Capture 4	Output B Command (PWM/DAC)
	Base + 1Ch	PWM Freq/Dead time/PFM Width 1-4	PWM C4
	Base + 1Dh	Control Word 4	Ext ADC_A
	Base + 1Eh	Enc Compare Auto Increment 4	Ext ADC_B
	Base + 1Fh	Enc Compare Value B4	Enc Compare Value B4

Ext ADC_A and Ext ADC_B are the addresses of the A-D converters. The data is stored into registers every PHASE cycle.

Board Configuration Memory Map

The board configuration memory mapping for UMAC Turbo models contains data pertaining to the configuration of products that are plugged into the UBUS backplane.

On power-up or at any time that is needed, the UBUS processor (normally a Turbo UMAC processor) is capable of polling this block of memory to establish the mapping of hardware.

Each block of memory contains four address locations that may be polled. There are two banks of four address locations that can be selected so that the processor can read data from up to eight address locations.

23 – 8	7	6	5	4	3 – 0		
Reference counter register (bits 8 – 17)				BANK	Vendor Code	BASE	BANK 0
Output magnitude (range 0 – 15)				BANK	Vendor Code	+1	BANK 0
Offset Delay Control (range 0-511)				Option Code	Option Code	+2	BANK 0
Generator Frequency Control 0 = Phase 1 = Phase/2 2 = Phase/4 3= Phase/6				Option Code	Option Code	+3	BANK 0
				BANK	Revision	BASE	BANK 1
				BANK	Card Type	+1	BANK 1
				Card Type	Card Type	+2	BANK 1
				Card Type	Card Type	+3	BANK 1

Bank: Place a 0 into this bit to select BANK 0. Place a 1 into this bit to select BANK 1.

Vendor Code: Delta Tau Data Systems Inc. products will always have a 1 in this 4 bit address field. Products from other companies will have other values returned in this field.

Option Code: This 5-bit field contains data that pertains to options that are installed on the accessory card. Each product will have a different meaning to the data in this field.

Revision: This 4-bit field indicates the revision level the board assembly. This value is usually hard coded in the circuitry of the board fabrication.

Card Type: This-14 bit address field contains information pertaining to a part number assigned to the board. This value usually relates to a vendor's board assembly part number. Delta Tau Data Systems Inc. uses their 6-digit part number converted to hexadecimal in this field.

Option Codes: The CS2 and CS3 selects that are used for the Acc-51E and axis cards allows for up to 16 board configuration slots to be used. The dipswitch selects between any of the 16 banks of memory. This allows for up to 16 Acc-51Es to be logically configured.

Reference counter register (bits 8 – 17): This register has a counter in it that is latched at the same time as the A-D converters. Bit 17 is used to establish the whether the arctangent result of the resolver's data is in the positive or negative side of the sin profile.

Output magnitude (range 0 – 15): This register is used to set the output level of the output sinusoidal profile. Default value is 1.

Offset Delay Control (range 0-511): The register creates an offset to the sinusoidal profile. Normally, this value does not need to be changed. Default value is 1.

Generator Frequency Control: 0 = Phase, 1 = Phase/2, 2 = Phase/4, 3= Phase/6
The register divides the output frequency from the PHASE clock of the UMAC. Set this divider so that the resolver generator frequency matches the SERVO clock frequency.